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In This Issue

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The Crushed Stone Journal

Official Publication of the NATIONAL CRUSHED STONE ASSOCIATION

J. R. BOYD, Editor

NATIONAL CRUSHED STONE ASSOCIATION

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The National Crushed Stone Association Safety Competition of 1939

By T. D. LAWRENCE and
J. E. ISAACSON

Under supervision of W. W. Adams,
Employment Statistics Section,
Mineral Production and Economics Division,
U. S. Bureau of Mines.

• **Port Inland Limestone quarry of the Inland Lime and Stone Company wins N. C. S. A. Safety Contest for second successive year. Honorable mention given 21 plants for accident-free record.**

THE year 1939 completed the fourteenth annual safety competition conducted by the Bureau of Mines, in cooperation with the National Crushed Stone Association; and the results of the contest revealed a 21 per cent betterment in the accident-frequency rate and 4 per cent in the accident-severity rate over the previous year's record. Forty-eight plants participated, all being members of the National Crushed Stone Association.

The combined record of the 44 open quarries and 4 underground mines showed an operation of 4,612,125 man-hours, a reduction of 8 per cent from 1938. The number of injuries in 1939 decreased 27 per cent and the days of disability 11 per cent from the previous year's figures. The combined accident-frequency rate for the open quarries and underground mines was 13.660, the lowest in the 14-year period, and the accident-severity rate was 4.236. Corresponding rates for 1938 were 17.226 and 4.390.

The award, a bronze plaque on which is portrayed in bas-relief the quarry scene on the pedestal of the

EMPLOYEES AT THE CRUSHING AND SCREENING PLANT OF THE PORT INLAND LIMESTONE QUARRY, INLAND LIME AND STONE COMPANY, MANISTIQUE, MICHIGAN, WINNER OF THE N. C. S. A. SAFETY CONTEST FOR 1939.

'Sentinels of Safety' trophy awarded in the National Safety Competition, is provided by the *Explosives Engineer* magazine to the winning plant.

The 1939 trophy was won by the Port Inland limestone quarry of the Inland Lime and Stone Company. This quarry had an accident-free record with 458,892 man-hours. In 1938, also, the Port Inland limestone quarry won the trophy and it has operated a total of 758,643 man-hours without a lost-time injury in the two years. The quarry is in Mackinac

TABLE 1

RELATIVE STANDING OF QUARRIES IN THE 1939 NATIONAL CRUSHED STONE ASSOCIATION SAFETY COMPETITION, BASED UPON THE ACCIDENT-SEVERITY RATES OF THE QUARRIES

Code No.	Group No.	Man-hours worked	Number of injuries [2]					Average days of disability per temp. injury	Number of days of disability [2]					Frequency rate [3]	Severity rate [3]
			F.	P.T.	P.P.	Temp.	Total		F.	P.T.	P.P.	Temp.	Total		
1	1	458,892	—	—	—	—	—	—	—	—	—	—	—	0.000	0.000
2	2	164,738	—	—	—	—	—	—	—	—	—	—	—	.000	.000
3	3	139,606	—	—	—	—	—	—	—	—	—	—	—	.000	.000
4	4	123,448	—	—	—	—	—	—	—	—	—	—	—	.000	.000
5	5	106,632	—	—	—	—	—	—	—	—	—	—	—	.000	.000
6	6	81,140	—	—	—	—	—	—	—	—	—	—	—	.000	.000
7	7	74,822	—	—	—	—	—	—	—	—	—	—	—	.000	.000
8	8	69,195	—	—	—	—	—	—	—	—	—	—	—	.000	.000
9	9	67,881	—	—	—	—	—	—	—	—	—	—	—	.000	.000
10	10	61,194	—	—	—	—	—	—	—	—	—	—	—	.000	.000
11	11	60,816	—	—	—	—	—	—	—	—	—	—	—	.000	.000
12	12	60,049	—	—	—	—	—	—	—	—	—	—	—	.000	.000
13	13	58,442	—	—	—	—	—	—	—	—	—	—	—	.000	.000
14	14	55,704	—	—	—	—	—	—	—	—	—	—	—	.000	.000
15	15	51,567	—	—	—	—	—	—	—	—	—	—	—	.000	.000
16	16	50,213	—	—	—	—	—	—	—	—	—	—	—	.000	.000
17	17	38,601	—	—	—	—	—	—	—	—	—	—	—	.000	.000
18	18	38,445	—	—	—	—	—	—	—	—	—	—	—	.000	.000
19	19	35,450	—	—	—	—	—	—	—	—	—	—	—	.000	.000
20	20	22,689	—	—	—	—	—	—	—	—	—	—	—	.000	.000
21	21	21,755	—	—	—	—	—	—	—	—	—	—	—	.000	.000
22	22	14,520	—	—	—	—	—	—	—	—	—	—	—	.000	.000
23	23	252,479	—	—	—	1	1	5	—	—	—	5	5	3.961	.020
24	24	119,667	—	—	—	1	1	3	—	—	—	3	3	8.357	.025
25	25	70,186	—	—	—	1	1	5	—	—	—	5	5	14.248	.071
26	26	206,661	—	—	—	1	1	28	—	—	—	28	28	4.839	.135
27	27	72,192	—	—	—	3	3	7	—	—	—	22	22	41.556	.305
28	28	106,469	—	—	—	1	1	38	—	—	—	38	38	9.392	.357
29	29	20,512	—	—	—	2	2	5	—	—	—	10	10	97.504	.488
30	30	99,510	—	—	—	2	2	26	—	—	—	51	51	20.098	.513
32	31	66,890	—	—	—	1	1	48	—	—	—	48	48	14.950	.718
33	32	96,352	—	—	—	1	1	81	—	—	—	81	81	10.379	.841
34	33	216,952	—	—	—	4	4	53	—	—	—	211	211	18.437	.973
36	34	29,227	—	—	—	4	4	8	—	—	—	30	30	136.860	1.026
37	35	83,128	—	—	—	2	2	47	—	—	—	94	94	24.059	1.131
39	36	21,421	—	—	—	1	1	25	—	—	—	25	25	46.683	1.167
40	37	294,401	—	—	1	5	6	22	—	—	300	109	409	20.380	1.389
41	38	170,569	—	—	—	15	15	20	—	—	—	301	301	87.941	1.765
42	39	56,821	—	—	—	1	1	118	—	—	—	118	118	17.599	2.077
43	40	92,598	—	—	—	1	1	220	—	—	—	220	220	10.799	2.376
44	41	48,484	—	—	—	1	1	169	—	—	—	169	169	20.625	3.486
46	42	188,186	1	—	—	1	2	58	6,000	—	—	58	6,058	10.628	32.192
47	43	46,251	—	—	1	1	2	48	—	—	4,500	48	4,548	43.242	98.333
48	44	4,331	1	—	—	1	2	4	6,000	—	—	4	6,004	461.787	1386.285
Totals and rates, 1939		4,219,086	2	0	2	51	55	33	12,000	0	4,800	1,678	18,478	13.036	4.380
Totals and rates, 1938		4,656,119	2	0	6	76	84	42	12,000	0	6,600	3,184	21,784	18.033	4.677

[1] As reports from mining companies are considered confidential by the Bureau of Mines, the identities of the plants to which this table relates are not revealed.

[2] F., fatal; P.T., permanent total disability; P.P., permanent partial disability; Temp., temporary disability.

[3] Frequency rate indicates the number of fatal, permanent, and other disabling injuries per million man-hours of exposure; severity rate indicates number of days of disability lost from injuries per thousand man-hours.

County and the crusher in Schoolcraft County, Michigan.

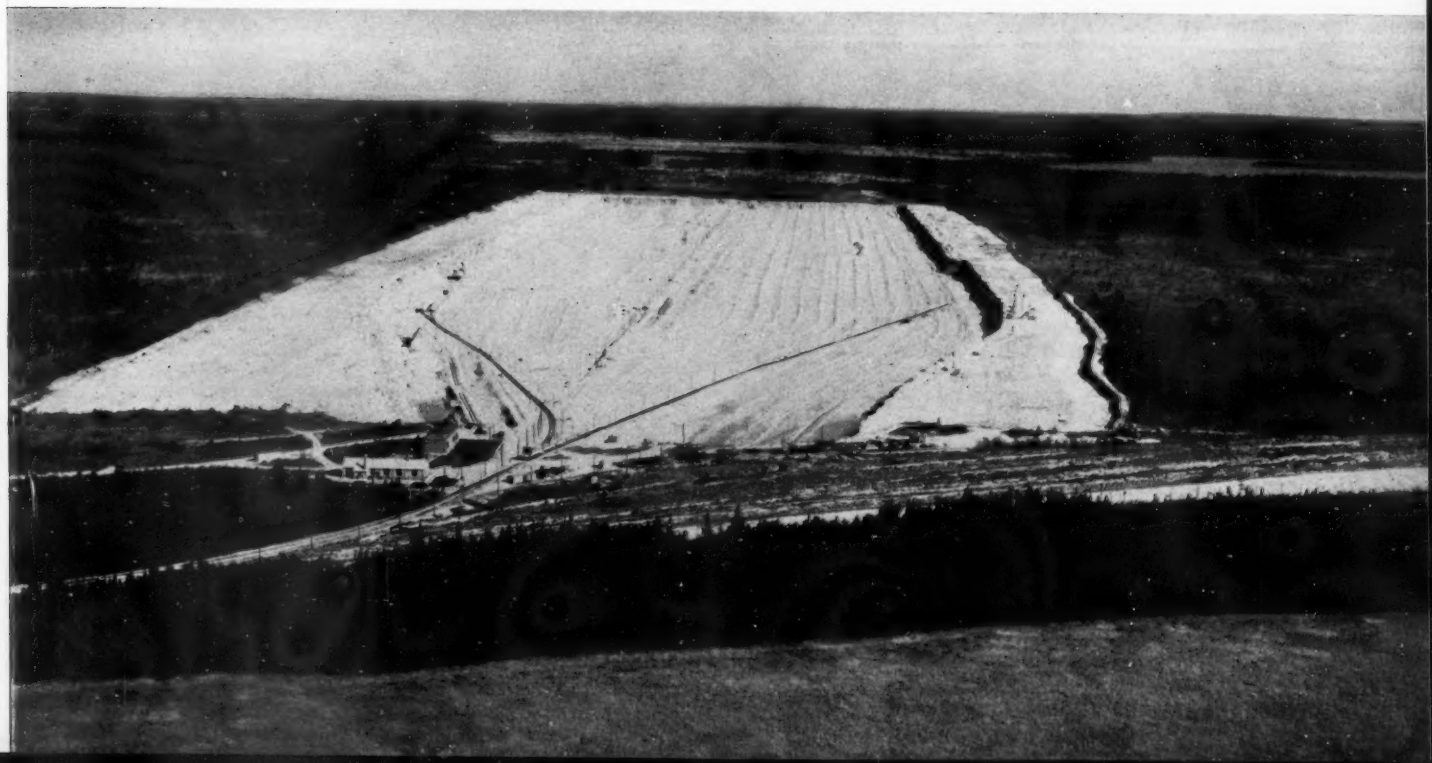
Each plant, except the winner, that operated throughout the contest year without a lost-time injury receives honorable mention and is presented a parchment reproduction of the *Explosives Engineer* award. In addition, each employee of the winning

SUPERVISORY SAFETY ORGANIZATION, INLAND LIME AND STONE CO., MANISTIQUE, MICHIGAN.

plant and of the plants receiving honorable mention is presented a certificate of honor. The 21 plants receiving honorable mention were:

1. No. 7 trap-rock quarry, North Branford, New Haven County, Conn., operated by The New Haven Trap Rock Co., operated 164,738 man-hours.
2. Piqua limestone quarry, Piqua, Miami County, Ohio, operated by The Ohio Marble Co., operated 139,606 man-hours.
3. Guilquarry granite quarry, Stokesdale, Guilford County, N. C., operated by the Raleigh Granite Co., a division of Southern Aggregates Corporation, Raleigh, N. C., operated 123,448 man-hours.
4. Oglesby limestone quarry, Oglesby, La Salle County, Ill., operated by the Marquette Cement Mfg. Co., operated 106,632 man-hours.
5. North American limestone quarry, Berkeley (near Martinsburg), Berkeley County, W. Va., operated by the North American Cement Corporation, operated 81,140 man-hours.
6. Geneva limestone quarry, Oaks Corners, Ontario County, N. Y., operated by The General Crushed Stone Co., operated 74,822 man-hours.
7. Cedar Hollow limestone quarry, Devault, Chester County, Pa., operated by the Warner Co., operated 69,195 man-hours.

AERIAL VIEW OF QUARRY, LOCATED EIGHT MILES INLAND.



8. White Haven sandstone quarry, White Haven, Luzerne County, Pa., operated by The General Crushed Stone Co., operated 67,881 man-hours.

9. Rock Hill trap-rock quarry, Quakertown, Bucks County, Pa., operated by The General Crushed Stone Co., operated 61,194 man-hours.

10. Holston limestone quarry, Mascot, Knox County, Tenn., operated by the American Zinc Co. of Tennessee, operated 60,816 man-hours.

11. Union Furnace limestone quarry, Huntingdon County, Pa., near Tyrone, Blair County, Pa., operated by the American Lime and Stone Co., operated 60,049 man-hours.

TABLE 2

RELATIVE STANDING OF UNDERGROUND MINES IN THE 1939 NATIONAL CRUSHED STONE ASSOCIATION SAFETY COMPETITION, BASED UPON THE ACCIDENT-SEVERITY RATES OF THE MINES[1]

Code No.	Group No.	Man-hours worked	Number of injuries[2]					Average days of disability per temp. injury	Number of days of disability[2]					Frequency rate[3]	Severity rate[3]
			F.	P.T.	P.P.	Temp.	Total		F.	P.T.	P.P.	Temp.	Total		
31	1	155,410	—	—	—	2	2	50	—	—	—	100	100	12.869	0.643
35	2	111,040	—	—	—	2	2	55	—	—	—	111	111	18.012	1.000
38	3	58,841	—	—	—	1	1	67	—	—	—	67	67	16.995	1.139
45	4	67,748	—	—	1	2	3	90	—	—	600	179	779	44.282	11.498
Totals and rates, 1939		393,039	0	0	1	7	8	65	0	0	600	457	1,057	20.354	2.639
Totals and rates, 1938		334,422	0	0	0	2	2	67	0	0	0	133	133	5.980	.398

[1] As reports from mining companies are considered confidential by the Bureau of Mines, the identities of the plants to which this table relates are not revealed.

[2] F., fatal; P.T., permanent total disability; P.P., permanent partial disability; Temp., temporary disability.

[3] Frequency rate indicates the number of fatal, permanent, and other lost-time injuries per million man-hours of exposure; severity rate indicates number of days from injuries per thousand man-hours.

TABLE 3

YEARLY SUMMARY—OPEN QUARRIES IN THE NATIONAL CRUSHED STONE ASSOCIATION SAFETY COMPETITION, 1926-39

Year	Plants	Man-hours worked	Number of injuries[1]					Number of days of disability[1]					Frequency rate[2]	Severity rate[2]
			Fatal	P.T.	P.P.	Temp.	Total	Fatal	P.T.	P.P.	Temp.	Total		
1925[3]	38	4,927,402	4	——	3	292	299	24,000	——	3,600	5,286	32,886	60.681	6.674
1926	40	5,298,983	3	——	6	207	216	18,000	——	9,000	4,239	31,239	40.763	5.895
1927	48	7,876,791	9	——	2	458	469	54,000	——	2,100	7,186	63,286	59.542	8.034
1928	53	7,509,098	8	——	4	322	334	48,000	——	8,700	5,493	62,193	44.479	8.282
1929	53	7,970,325	4	——	5	286	295	24,000	——	5,760	5,533	35,293	37.012	4.428
1930	68	8,013,415	6	——	9	227	242	36,000	——	7,250	3,671	46,921	30.199	5.855
1931	58	5,085,857	4	——	13	198	215	24,000	——	18,660	3,540	46,200	42.274	9.084
1932	40	2,661,850	1	——	4	75	80	6,000	——	6,750	2,481	15,231	30.054	5.722
1933	40	2,704,871	1	——	1	67	68	6,000	——	48	2,893	8,941	25.510	3.306
1934	46	3,288,257	1	——	2	106	109	6,000	——	2,850	1,873	10,723	33.148	3.261
1935	46	4,166,306	2	1	8	77	88	12,000	6,000	9,900	3,015	30,915	21.122	7.420
1936	50	6,399,023	5	——	14	182	201	30,000	——	8,168	4,590	42,758	31.411	6.682
1937	47	6,199,001	7	——	9	136	152	42,000	——	5,875	4,461	52,336	24.520	8.443
1938	47	4,658,119	2	——	6	76	84	12,000	——	6,600	3,184	21,784	18.033	4.677
1939	44	4,219,086	2	——	2	51	55	12,000	——	4,800	1,678	18,478	13.036	4.380
Total 1926-39	—	76,050,982	55	1	85	2,438	2,609	330,000	6,000	96,461	53,837	486,298	34.306	6.394
Total 1925-39	—	80,978,384	59	1	88	2,760	2,908	354,000	6,000	100,061	59,123	519,184	35.911	6.411

[1] P.T., permanent total disability; P.P., permanent partial disability; and Temp., temporary disability.

[2] Frequency rate indicates number of fatal, permanent, and other lost-time injuries per million man-hours of exposure; severity rate indicates number of days of disability from injuries per thousand man-hours.

[3] The National Crushed Stone Association Safety Competition began in 1926; figures for 1925 for company members are given for comparison.

TABLE 4

YEARLY SUMMARY—UNDERGROUND MINES IN THE NATIONAL CRUSHED STONE ASSOCIATION SAFETY COMPETITION, 1926-39

Year	Plants	Man-hours worked	Number of injuries [1]					Number of days of disability [1]					Frequency rate [2]	Severity rate [2]
			Fatal	P.T.	P.P.	Temp.	Total	Fatal	P.T.	P.P.	Temp.	Total		
1925[3]	3	400,672	—	—	—	29	29	—	—	—	228	228	72.378	0.569
1926	3	517,926	—	—	—	34	34	—	—	—	533	533	65.646	1.029
1927	2	318,449	1	—	1	14	16	6,000	—	300	68	6,368	50.244	19.997
1928	5	542,193	1	—	1	68	70	6,000	—	300	888	7,188	129.105	13.257
1929	4	665,520	1	—	1	30	32	6,000	—	300	617	6,917	48.083	10.393
1930	6	595,367	1	—	1	15	17	6,000	—	225	468	6,693	28.554	11.242
1931	3	345,105	—	—	—	4	4	—	—	—	147	147	11.591	.426
1932	2	158,450	—	—	—	6	6	—	—	—	165	165	37.867	1.041
1933	3	229,381	—	—	—	11	11	—	—	—	349	349	47.955	1.521
1934	4	248,146	—	—	—	13	13	—	—	—	287	287	52.389	1.157
1935	2	175,994	—	—	—	3	3	—	—	—	249	249	17.046	1.415
1936	4	334,747	1	—	—	7	8	6,000	—	—	117	6,117	23.899	18.274
1937	3	364,680	—	—	—	3	3	—	—	—	91	91	8.226	.250
1938	3	334,442	—	—	—	2	2	—	—	—	133	133	5.980	.398
1939	4	393,039	—	—	1	7	8	—	—	600	457	1,057	20.354	2.689
Total 1926-39	—	5,223,419	5	0	5	217	227	30,000	0	1,725	4,569	36,294	43.458	6.948
Total 1925-39	—	5,624,111	5	0	5	246	256	30,000	0	1,725	4,797	36,522	45.518	6.494

[1] P.T., permanent total disability; P.P., permanent partial disability; and Temp., temporary disability.

[2] Frequency rate indicates number of fatal, permanent, and other lost-time injuries per million man-hours of exposure; severity rate indicates number of days of disability from injuries per thousand man-hours.

[3] The National Crushed Stone Association Safety Competition began in 1926; figures for 1925 for company members are given for comparison.

12. Jordanville limestone quarry, Jordanville, Herkimer County, N. Y., operated by The General Crushed Stone Co., operated 58,442 man-hours.

13. Marquette limestone quarry, Cape Girardeau, Cape Girardeau County, Mo., operated by the Marquette Cement Mfg. Co., operated 55,704 man-hours.

14. Winchester trap-rock quarry, Winchester, Middlesex County, Mass., operated by The General Crushed Stone Co., operated 51,567 man-hours.

15. Plainville No. 4 trap-rock quarry, Plainville, Hartford County, Conn., operated by The New Haven Trap Rock Co., operated 50,213 man-hours.

16. Auburn limestone quarry, Auburn, Cayuga County, N. Y., operated by The General Crushed Stone Co., operated 38,601 man-hours.

17. Middlefield No. 1 trap-rock quarry, New Haven County, Conn., near Middlefield, Middlesex County, Conn., operated by The New Haven Trap Rock Co., operated 38,445 man-hours.

18. No. 3 limestone quarry, Stringtown, Atoka County, Okla., operated by the Southwest Stone Co., operated 35,450 man-hours.

QUARRY EMPLOYEES OF THE PORT INLAND LIMESTONE QUARRY OF THE INLAND LIME AND STONE COMPANY, MANISTIQUE, MICHIGAN.

TABLE 5

YEARLY SUMMARY—OPEN QUARRIES AND UNDERGROUND MINES IN THE NATIONAL CRUSHED STONE ASSOCIATION SAFETY COMPETITION, 1926-39

Year	Plants	Man-hours worked	Number of injuries [1]					Number of days of disability [1]					Frequency rate [2]	Severity rate [2]
			Fatal	P.T.	P.P.	Temp.	Total	Fatal	P.T.	P.P.	Temp.	Total		
1925[3]	41	5,328,074	4	——	3	321	328	24,000	——	3,600	5,514	33,114	61.561	6.215
1926	43	5,816,909	3	——	6	241	250	18,000	——	9,000	4,772	31,772	42.978	5.462
1927	50	8,195,240	10	——	3	472	485	60,000	——	2,400	7,254	69,654	59.181	8.499
1928	58	8,051,291	9	——	5	390	404	54,000	——	9,000	6,381	69,381	50.178	8.617
1929	57	8,635,845	5	——	6	316	327	30,000	——	6,060	6,150	42,210	37.865	4.888
1930	74	8,608,782	7	——	10	242	259	42,000	——	7,475	4,139	53,614	30.086	6.228
1931	61	5,430,962	4	——	13	202	219	24,000	——	18,660	3,687	46,347	40.324	8.534
1932	42	2,820,300	1	——	4	81	86	6,000	——	6,750	2,646	15,396	30.493	5.459
1933	43	2,934,252	1	——	1	78	80	6,000	——	48	3,242	9,290	27.264	3.166
1934	50	3,536,403	1	——	2	119	122	6,000	——	2,850	2,160	11,010	34.498	3.113
1935	48	4,342,300	2	1	8	80	91	12,000	6,000	9,900	3,264	31,164	20.957	7.177
1936	54	6,733,770	6	——	14	189	209	36,000	——	8,168	4,707	48,875	31.038	7.258
1937	50	6,563,681	7	——	9	139	155	42,000	——	5,875	4,552	52,427	23.615	7.987
1938	50	4,992,561	2	——	6	78	86	12,000	——	6,600	3,317	21,917	17.226	4.390
1939	48	4,612,125	2	——	3	58	63	12,000	——	5,400	2,135	19,535	13.660	4.236
Total 1926-39	—	81,274,421	60	1	90	2,685	2,836	360,000	6,000	98,186	58,406	522,592	34.894	6.430
Total 1925-39	—	86,602,495	64	1	93	3,006	3,164	384,000	6,000	101,786	63,920	555,706	36.535	6.417

[1] P.T., permanent total disability; P.P., permanent partial disability; and Temp., temporary disability.

[2] Frequency rate indicates number of fatal, permanent, and other lost-time injuries per million man-hours of exposure; severity rate indicates number of days of disability from injuries per thousand man-hours.

[3] The National Crushed Stone Association Safety Competition began in 1926; figures for 1925 for company members are given for comparison.

19. Reidsville granite quarry, Reidsville, Rockingham County, N. C., operated by the Southern Aggregates Corporation, operated 22,689 man-hours.

20. Granby No. 5 trap-rock quarry, West Suffield, Hartford County, Conn., operated by The New Haven Trap Rock Co., operated 21,755 man-hours.

21. North American limestone quarry, Howes Cave, Schoharie County, N. Y., operated by the North American Cement Corporation, operated 14,520 man-hours.

Eighteen States were represented in the 1939 National Crushed Stone Association Safety Competition. The States were:

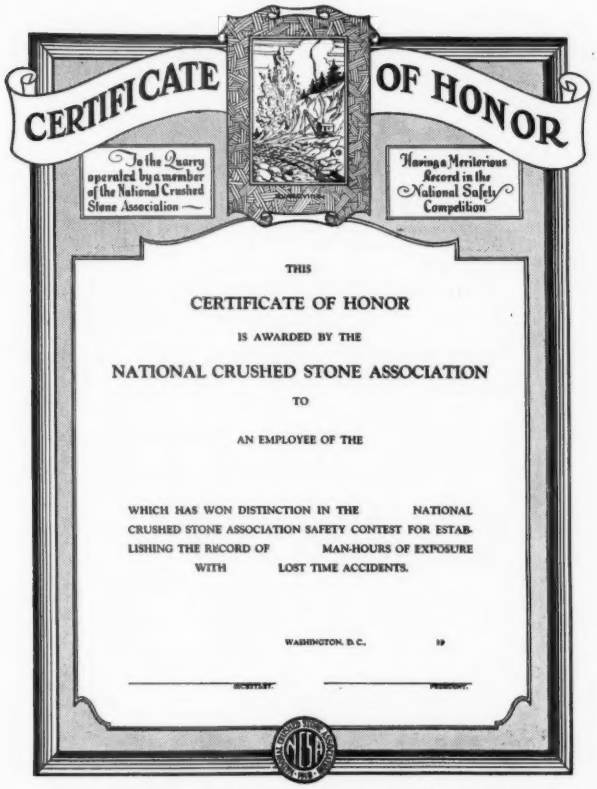
California	Maryland	New York
Connecticut	Massachusetts	North Carolina
Georgia	Michigan	Ohio
Illinois	Missouri	Oklahoma
Pennsylvania	Tennessee	Virginia
South Carolina	Texas	West Virginia

The 44 open quarries, 3 less than in 1938, operated 4,219,086 man-hours, a reduction of 9 per cent from the 1938 figure. The 1939 accident-frequency rate of 13.036, the lowest since the contests were organized, showed an improvement of 28 per cent; and the accident-severity rate of 4.380, an improvement of 6 per cent compared with the 1938 rates of 18.033 and 4.677, respectively. Only two years, 1933 and 1934, had a lower accident-severity rate than 1939. There were 55 injuries—2 fatal, 2 permanent partial, and 51 temporary—causing 18,478 days of disability. Fatal and permanent total injuries are each charged with 6,000 days of disability. Permanent partial injuries are charged with the days specified in the time scale in the rules. In cases involving a per cent of loss of use of, only that per cent of the total loss is charged; for example, 25 per cent loss of use of a finger is 75 days of disability. Temporary injuries are charged with the actual calendar days of disability including Sundays and holidays if the injured employee was incapacitated on those days.

TABLE 6

AVERAGE DAYS OF DISABILITY FOR TEMPORARY INJURIES AT PLANTS ENROLLED IN THE NATIONAL CRUSHED STONE ASSOCIATION SAFETY COMPETITION

Year	Underground mines			Open quarries			Total		
	No. of temporary injuries	No of days of disability	Av. days of disability	No. of temporary injuries	No. of days of disability	Av. days of disability	No. of temporary injuries	No. of days of disability	Av. days of disability
1925	29	228	8	292	5,286	18	321	5,514	17
1926	34	533	16	207	4,239	20	241	4,772	20
1927	14	68	5	458	7,186	16	472	7,254	15
1928	68	888	13	322	5,493	17	390	6,381	16
1929	30	617	21	286	5,533	19	316	6,150	19
1930	15	468	31	227	3,671	16	242	4,139	17
1931	4	147	37	198	3,540	18	202	3,687	18
1932	6	165	28	75	2,481	33	81	2,646	33
1933	11	349	32	67	2,893	43	78	3,242	42
1934	13	287	22	106	1,873	18	119	2,160	18
1935	3	249	83	77	3,015	39	80	3,264	41
1936	7	117	17	182	4,590	25	189	4,707	25
1937	3	91	30	136	4,461	33	139	4,552	33
1938	2	133	67	76	3,184	42	78	3,317	43
1939	7	457	65	51	1,678	33	58	2,135	37
Total	246	4,797	20	2,760	59,123	21	3,006	63,920	21



Presented to Each Employee of Each Plant Completing the Year with No Lost Time Accidents.

The underground-mine group comprising 4 mines operated 393,039 man-hours, a slight increase over 1938. There were 8 injuries causing 1,057 days of disability; 1 was a permanent partial with 600 days of disability, and 7 were of a temporary nature with 457 days. The 1939 rates were worse than those of 1938, due to more severe injuries. In comparing the 1939 rates with those of the 14-year period, the 1939 rates are more than 50 per cent better than the average.

The average days of disability for temporary injuries decreased in both open quarries and underground mines; the quarry group had 33 days in 1939 compared with 42 in 1938, and the underground-mine group had 65 in 1939 and 67 in 1938.

Tables 1 and 2 show the relative standing of plants enrolled in the contest arranged according to their accident-severity rates. When two or more plants have accident-free records, the number of man-hours governs the order. Tables 3 and 4 show yearly summary figures from 1926 to 1939, and for Association members for 1925, the year before the contests were organized. Table 5 shows a yearly combined summary of open-quarries and underground mines in the National Crushed Stone Association Safety Competition. Table 6 shows the average days of disability for temporary injuries at mines and quarries enrolled in the contest.

Roads and the Public[1]

By COL. WILLARD T. CHEVALIER

Vice President, McGraw-Hill Publishing Co., Past President, American Road Builders' Association

• Business men should insist on more highway knowledge.

A MAN, a citizen, regards his house, his car, and feels the pride of ownership. The same man regards a road—and regards it. His house was built with his money. He bought his car. He also contributed to the construction of the road with his tax money. The difference, of course, may be expressed by the fact that he can hardly bequeath a stretch of public road to his wife or children. The truth remains, however, that his title of ownership to the road is just as strong as the next man's.

There's another way of looking at it. The roads, public roads, belong to the state. The state belongs to the people. He is one of the people. It adds up to the same result.

This man can tell you the make, the license number, the speed, the color, the cost of his car. He can tell you the size, the type, the cost of his house. But, if he is the average citizen, he is not familiar with road problems. He does not have the simplest idea of how highways are planned, built or administered.

Roads At Fault

Newspapers inform him that hundreds are killed and injured each day of the year in motor-vehicle accidents. It's an odds-on wager that he attributes these accidents wholly to bad driving or an act of God. He does not know that traffic experts estimate that, at the very least, the number of accidents could be minimized fifty per cent by the design and construction of more modern roads that would eliminate motoring hazards and possess "in-built" safety features. He is not aware that crooked roads, poor sight-distances, steep grades, narrow roads, soft shoulders, "dark" roads, slippery roads—to mention several accident-provoking road faults—are basically the background for most highway horrors.

Caught in a traffic jam, he squawks about too many automobiles and trucks in use. Of course there are too many—too many for an inadequate American highway-and-street system. And motor-vehicles continue to be put into operation at such a rate that automotive experts predict that within the next ten years ten million more will be added to the total of thirty million already swarming American roads.

The single answer to the problem lies in roads. More, wider, straighter, better, safer roads must be built to keep pace with automotive output. If not, congestion of traffic will continue to slow up production and distribution. If not, the annual toll of more than 35,000 highway fatalities and well over a million injured will unalterably increase. This man who owns the roads—he should certainly know that at least 100,000 miles of his primary road system are obsolete!

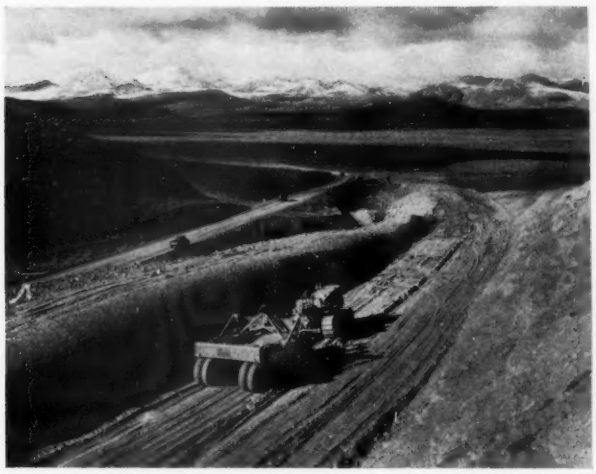
Highway engineers know the solution to most of our highway problems. They know how to build better, safer roads to meet modern traffic demands. The barrier that stands in their way is lack of funds. They can only obtain these funds with the cooperation of the general public which pays for highway projects. The nation's most progressive highway engineers are, therefore, discovering that they can best secure public co-operation through an intelligent program of public relations. It's more than worth the try. As Abraham Lincoln said, "He who moulds public opinion is greater than he who enacts laws."

Education Needed

A good teacher is not a person who imparts knowledge only when information is requested. A good teacher stimulates the pupil's interest, arouses his desire to know. Road administrators, planners and builders may be considered in the same category as teachers. And the reason the average citizen does not know more about roads is largely attributable to the men who build them. Road builders would do well to give a great deal more attention to public relations. After all, the people do own the roads. If the people do not realize the ill-condition and inade-

[1] Reprinted from the June, 1940 number of *Toledo Business*, Official Publication of the Toledo Chamber of Commerce and the Toledo Junior Chamber of Commerce, Toledo, Ohio.

quacy of the American highway system, nothing will be done to remedy those faults. Roads will be constructed—and quickly—when the pressure of public opinion gets behind a "better roads" movement and drives it forward. The answer is public relations.



HIGHWAY MODERNIZATION ON ROUTE 40, UTAH.

The great industries of the country have long realized the extreme importance of public relations. Their annual budgets reserve very substantial appropriations for use in acquainting their consumers, the public, with facts related to their operations. Road building in America today is a top-flight industry. Automobile owners contributed a billion and a half dollars to tax funds in 1939. Most of these funds will be spent for road construction and maintenance. There are nearly four million miles of roads in the nation, one-third of the world's total mileage. These roads are, in large part, obsolete. They were constructed for the vehicular traffic of yesterday. This inadequate system of highways belongs to the public. And the public is in the position of stockholders in an industry and in the position of consumers of the industry's products who know nothing of the operations of that industry. Except in a few isolated but outstanding instances, the road-building industry obviously is failing to place proper stress on its relations with the public.

One of these outstanding instances may be found at the American Road Builders' Association which maintains headquarters in Washington, D. C. This association pretty well represents every phase of the road-building industry. It realizes its responsibility to the public and knows the industry it represents will greatly benefit through public knowledge of its operations.

More Teachers

The ARBA Public Relations Division, an organization in itself, carries on an extensive public educational campaign through press and radio. It publishes a monthly magazine, "Road Builders' News." News, magazine and radio script writers and producers are employed in the division. It promotes attendance at the ARBA Road Show-Convention, the annual conclave of the nation's road builders, where highway experts from all the world discuss the newest road-building ideas and methods. Due in some part to the efforts of the ARBA Public Relations Division, over 40,000 road builders from all the United States and thirty-six foreign nations gathered in Chicago, January 29-February 2, to discuss mutual problems and preview the latest developments in road-building equipment, displayed at the Road Show.

But although the American Road Builders' Association is an outstanding exponent of public relations, the example is a rare one. Road administrators, planners and builders of county, city and state would do well to emulate the methods of the asso-

STRAIGHTENING ALTAMONT PASS TO SPEED TRAFFIC BETWEEN CALIFORNIA'S EAST BAY AND THE SAN JOAQUIN VALLEY.

ciation. They have a duty to perform as teachers. Every citizen has a right to know more about his possession—the American highway. And the impartation and dissemination of that knowledge through well-directed public relations efforts will mean the faster construction of an adequate system of modern motorways.

Limestone "Sand" and Limestone "Dust" for Mortar and Concrete*

By J. SINGLETON-GREEN,
M.Sc., M.I.Struct.E., M.Inst.Q.
Author of "Concrete Engineering" and "Reinforced Concrete Roads"

• **Concrete engineers and producers of stone sand in the United States will be interested in the present article by an English authority on concrete. Stone sand is found to be suitable as a fine concrete aggregate.**

THERE are many engineers who would not use limestone "dust" for cement mortar or concrete, and they would make the decision without bothering to find out just what the "dust" was, and whether their decision was justified.

Limestone Sand

Perhaps part of the trouble is due to the slackness of the limestone industry in allowing the word "dust" to cover a wide range of materials. For instance, one producer assumes 3/16″ and down limestone to be dust, and calls it just that; whereas when another producer talks of dust he means material passing the 170-mesh sieve. There are other gradings, between these two extremes, all assumed to be in the same classification. It is suggested, therefore, that the word "dust" should only be used for that portion of the limestone which would pass a 170-mesh sieve. Material which is 3/16″ and down, or 1/8″ and down, should be given another and more appropriate designation, such as "fine limestone," "limestone sand" or "fine limestone aggregate." In this article it will be referred to as "limestone sand."

Specifications for Fine Aggregate

In the writer's opinion, most modern specifications for fine aggregates for concrete work are too strict, as far as the very fine material is concerned. For instance, in the British Standard Specification (A. R. P. Series) for "Aggregates for Concrete Shelters Constructed in Situ," issued in July, 1939, it states that the fine aggregate "shall be well graded from 3/16″ to 100 mesh." There is no allowance for a reasonable amount of material passing the 100 mesh, apart from the statement that the "fine aggregate shall not contain silt in excess of 3 per cent. by weight." Surely this specification is far too strict for most practical jobs. In any commercial aggregate it is almost certain that there will be a small percentage passing the 100 mesh, and there should be some tolerance. That this is true in the case of limestone is shown by the following tests.

The writer has been given to understand that in the near future (perhaps before this article appears in print) a tolerance of 5 per cent. will be allowed. For limestone sand, at any rate, this would not appear to be enough. The idea behind these specification restrictions is that very fine material, or "dust," is harmful. But is it as harmful as has generally been supposed? Or, in limited quantities, is it harmful at all?

Two points arise:—

1. Is limestone sand satisfactory as a fine aggregate?
2. What quantity of limestone dust is permissible?

This article will not attempt to answer the second question completely, but there seems no doubt about the answer to the first.

Objections

Objections which have been raised to the use of limestone sand and the inclusion of limestone dust are:—

1. They react chemically with the cement.
2. They reduce the strength.
3. They reduce the durability of the finished product.
4. They increase the tendency to crack and craze.
5. They decrease workability.
6. They increase absorption and porosity.

The first objection is entirely without foundation, and it can be stated definitely that limestone, no matter what the size of the particles, does *not* react chemically with the cement. As for the other objections, they are largely answered by the following notes.

*Reprinted from *Cement, Lime & Gravel*, January 1940 Issue

Limestone for Products

At the 1927 Convention[1] of the American Concrete Institute, several products manufacturers referred to the advantage of adding a small proportion of limestone screenings to the mix.

W. H. Warford stated that when using an economic mix of sand and gravel it was found impossible to remove blocks from the machine without breakage. The addition of fine limestone to the mix corrected the difficulty.

B. Wilk said: "At our plant we could not get a really economical mix with the available sand and gravel, even though we used an almost theoretically perfect grading. We found that, even with an experienced man and good operators, blocks made exclusively of sand and gravel in a really lean mix would not stand up. The blocks would fall down on being taken from the machine. By substituting one-third limestone screenings of somewhat similar grading to the sand and gravel, except that 8 per cent. of the limestone passed a 100-mesh sieve, the blocks stood up satisfactorily and could be readily carried away from the machine."

L. Peyton stated that he found the addition of limestone screenings added to workability, allowed the particles to slip into place easily, sealed small pores, and allowed more water to be used, while the block could still be removed from the machine without breakage.

Limestone Improves Many Properties

Additional evidence of the same kind was given in an article[2] which appeared two years later, as will be seen by the following extract.

Through several years of experimenting it was found that substituting limestone for a portion of the sand lowered the absorption and increased the compressive strength. Between 5 and 10 per cent. of this limestone passed the 100-mesh sieve and undoubtedly this fine material united with the cement to form an abundance of paste which thoroughly coated each and every particle of the aggregate which in turn had a sort of lubricating effect on the mix, producing a denser concrete having a higher compressive strength.

The above statement is verified in the Portland Cement Association booklet on "The Manufacture of Concrete Masonry Units," which reads as follows: "In a recent series of tests on tamped concrete block, two varieties of fine aggregate containing relatively large percentages of dust finer than the 100-mesh sieve gave unexpectedly high strengths. Apparently a certain portion of very fine materials results in greater workability and increased strength."

The effect of the limestone is more noticeable in leaner mixes and this ought to convince the most sceptical that even a good mix can be improved by the addition of limestone although it does not contain a large amount of fine material. Manufacturers of pre-cast tanks, vats, septic tanks, sewer pipe, etc., have to withstand hydrostatic tests will find the addition of limestone very beneficial.

Limestone and Sand

In spite of evidence of this kind, engineers, products manufacturers and other interested parties in this country continued to prohibit the use of limestone sand and limestone dust. It seemed to the writer that some evidence of the behaviour of these materials in this country should be obtained. But it was difficult, owing to the above-mentioned objections. In 1926, 1927 and 1928 he obtained some rather startling test results, but unfortunately the figures are not now available. However, in 1936 there was an opportunity to compare limestone sand and ordinary sand in concrete.

Four gradings of limestone were submitted, and were found to have the following sieve analyses:

	A. %	B. %	C. %	D. %
Retained on 100-mesh sieve	100.0	100.0	98.6	81.8
" " 52 " "	100.0	100.0	97.6	67.0
" " 25 " "	100.0	100.0	96.8	47.0
" " 14 " "	100.0	100.0	93.6	20.6
" " 7 " "	100.0	100.0	61.4	Nil
" " 3/16 " "	100.0	81.5	Nil	
" " 3/8 " "	98.5	3.0		
" " 3/4 " "	3.8	Nil		
Fineness modulus	7.023	5.845	4.480	2.164
Material washed through 170-mesh sieve				19.2%

It will be seen that the fine material (sample D) contained about one-fifth passing the 170 mesh. Most engineers would condemn this out-of-hand, stating that the strength of the concrete would be reduced appreciably by such a large quantity of dust. A 6-inch cube was made, using equal parts by volume of A, B, C and D, and a corresponding cube was made with the same mix except that Trent sand was substituted for limestone D. The results are given below, the cubes being broken at 7 days.

[1] "Limestone Screenings in Concrete," *Concrete for the Builder and Concrete Products*, Nov., 1927.

[2] "Limestone Screenings Improve Concrete Products," L. C. Hill, *Rock Products*, 23 Nov., 1929.

Mix	Weight of Cube lbs.	Crushing Stress lbs. per sq. in.
No. 1—Equal parts of *A, B, C* and *D* mixed together. 4:1 mix. 1" slump	18.7	3795
No. 2—4:1 mix as above, but Trent sand substituted for limestone *D*	18.3	3300

It is realised that sweeping conclusions cannot be drawn from the results of single cubes, but unfortunately there was not sufficient material to make more extensive tests.

Cheddar Reservoir

Some engineers prefer tests from a job in progress. Limestone, both coarse and fine, was used in the construction of the Cheddar Reservoir, and the test results obtained may surprise those who consider limestone unsuitable for concrete.

The proportions[3] for the whole of the concrete with the exception of certain pre-cast blocks were 5:3:1. The aggregate used was 1-1/2" to 3/16" limestone, and the sand content a mixture of 50 per cent. Holm sand and 50 per cent. limestone crushing. Two gradings of fine limestone were used:—

1. Sand—mainly 1/4" to 1/20", but described as "1/8 inch limestone."

2. Dust—half of which passed the 180 mesh.

Tensile tests were made varying the proportion of 1/8" and dust, and a comparison was made with Ham River sand; these gave the following results which were the average of six samples in each case:

Mixture 1	Mixture 2
1 cement	1 cement
1½ dust	1 dust
1½ limestone	2 limestone
14 days—	
750 lb. per sq. in.	804 lb. per sq. in.
28 days—	
792 lb. per sq. in.	833 lb. per sq. in.
Mixture 3	**Mixture 4**
1 cement	1 cement
2 dust	3 Ham River sand
1 limestone	
696 lb. per sq. in.	534 lb. per sq. in.
747 lb. per sq. in.	553 lb. per sq. in.

Standard percolation tests of the four mixtures were made, the results being:—

Mixture 1.

14 Days. At 90 lb. the underside of the blocks was a little wet.

28 Days. At 130 lb. slight dampness was apparent on the under-surface of the blocks.

Mixture 2.

14 Days. Under-surface became a little damp at 90 lb. per sq. in.

28 Days. A small bead of water showed on the underside at 130 lb.

Mixture 3.

14 Days. One or two beads of water formed at 60 lb. per sq. in.

28 Days. As at 14 days, but with a pressure of 90 lb. per sq. in.

Mixture 4.

14 Days. A few small beads of water formed at 55 lbs. per sq. in.

28 Days. At 70-lb. pressure, water appeared on the under-surface.

Limestone Dust in Mortar

The gradation of stone[4] sand greatly influences the workability of concrete made with this material, used as a fine aggregate. If it is too coarse, a "grainy" mix results which is harsh working and which does not hold the mixing water in place. Fine stone dust greatly adds to the plasticity or workability of an otherwise harsh working mixture and from this standpoint "fines" are desirable. But the question arises: What effect does stone dust have on the physical properties of the concrete? Light is thrown on this question through a preliminary series of tests made in the National Crushed Stone Association laboratory.

Mortars were made up in the proportion of 1:2 by weight, using limestone sands having the following gradations:

Total per cent retained on—	Coarse	Medium	Fine
No. 4	0	0	0
8	5	3	0
16	50	38	25
30	70	60	50
50	90	80	70
100	97	93	90
Fineness modulus	3.12	2.74	2.35

To the stone sands of the above gradations, limestone dust passing the No. 200 sieve was added to the amounts of 10, 20, and 30 per cent. by weight of cement, equivalent to 5, 10, and 15 per cent. by weight of sand.

[3] "The Construction of Cheddar Reservoir," R. W. Hall, *Water and Water Engineering*, Midsummer, 1936.

[4] "Effect of Limestone Dust Admixtures on the Strength and Durability of Portland Cement Mortar," *Bureau of Engineering, National Crushed Stone Association, U. S. A.*, 2 Oct., 1937.

All mortars were mixed to approximately the same consistency as determined by the flow table. Finally, after 28 days' storage in the moist room, the specimens (2-in. cubes) were tested for absorption, crushing strength and resistance to freezing and thawing.

It was found that the finer the sand, the higher is the water-ratio required for equal flow or consistency. However, contrary to the general water-cement ratio strength relationship, higher strengths were obtained with the higher water-cement ratios. Likewise the finest sand produced a more resistant mortar in the freezing and thawing test than the coarsest sand, even though the absorption was at the same time higher with the finer gradations.

10 per cent. of dust by weight of cement (5 per cent. by weight of stone sand) increased the crushing strength and also the durability with all three sand gradations, but 20 per cent. increased the strength and durability only of the coarse and intermediate gradations. Finally, 30 per cent. of dust (15 per cent. by weight of sand) decreased the crushing strength particularly of the intermediate and fine gradations and shows no benefit so far as durability is concerned.

It seems reasonable to conclude from these tests that for 1:2 mortar a small amount of stone dust passing the No. 200 sieve, up to 5 per cent. by weight of sand, should improve the mortar-making properties of stone sands within the range of gradation shown, but that more than 10 per cent. may be harmful, particularly if the sand has a fine gradation.

If the results are further analysed, the indications from these tests point to the desirability of raising the allowable stone dust content above that ordinarily allowed by specifications, perhaps up to 15 per cent. passing through the No. 100 sieve.

Dust and Properties of Mortars

Tests were made in U. S. A. to gain additional information on the effect of various quantities of dust in stone sand on the properties of mortar such as might be used in highway concrete. In his article,[5] Goldbeck stated that the following brief summary of indications from the tests seemed warranted:—

1. To maintain a given consistency in mortars containing dust varying in amount from 4 up to 24 per cent., very little increase in water-cement ratio is required.

2. Neither the volume of water released upon settlement of the fresh mortar nor the volumetric shrinkage of the fresh mortar is affected to a significant extent by an increase in dust content up to 24 per cent.

3. Crushing strength of mortar is somewhat decreased with increasing percentages of dust. The crushing strength of the 24 per cent. dust content mortar was 90 per cent. of that containing only 4 per cent. dust.

4. The absorption increases with increasing percentages of dust.

5. The durability seems to be affected to a significant degree by high percentages of dust, far more than can be accounted for by the rather slight increase in water-cement ratio required to maintain the same consistency. It would seem inadvisable to use more than 8 to 10 per cent. of minus No. 100 sieve limestone dust in the stone sand used for concrete to be exposed to the weather.

6. The shrinkage of mortar upon drying out in the air is practically unaffected by the dust content in the sand.

Although the above tests were made on mortar, it is to be expected that concrete will be similarly affected, only to a different extent, and hence these tests are applicable qualitatively to concrete also. Finally, it seems safe for concrete containing 1:2 mortar to have at least 8 to 10 per cent. of stone dust passing the No. 100 sieve. Only one limestone sand and dust was used in these tests, and it is not improbable that other sands and dusts might give results varying somewhat from these.

Masonry Mortars

Most natural sands[6] are lacking in enough fine material to make them sufficiently plastic when made into masonry mortars. To overcome this lack of fines, hydrated lime is used as an admixture to Portland cement, or specially designed masonry cements are employed. Tests show that excellent masonry mortars may be made by the use of Portland cement mixed with fine stone sand containing a large quantity of dust. Frequently, also, stone sand containing a high percentage of dust may be used with very beneficial effects when mixed with natural sand. The following results are illustrative of the above statement:

[5] "The Effect of Dust in Stone Sand on the Properties of Mortars," A. T. Goldbeck, *The Crushed Stone Journal*, Nov.-Dec., 1938.

[6] "National Crushed Stone Association Engineering Investigations in 1938," A. T. Goldbeck, *The Crushed Stone Journal*, Jan.-Feb., 1939.

Proportions by Dry, Loose Volume			Crushing Strength Lbs. per sq. in. at 28 days
Cement	Stone Sand	River Sand	
1	3	—	5100
1	—	3	3970
1	1½	1½	5870

The gradations of the stone sand and river sand used in the above tests were as follows:

Sieve No.	Stone Sand	River Sand
	Total per cent retained	
4	0	0
8	7	9
16	44	22
30	60	39
50	67	86
100	71	100
200	74	100
Loss by washing	18.6	0.3

Roofing Tiles

The following are extracts (11th May, 1939) from a letter received from a company in the Midlands:

"We are large makers of concrete roofing tiles, and have many times made samples of roofing tiles with sand to compare them with the tiles we are making with limestone dust. In every case the tile made with limestone dust was far superior in texture and strength to the tile made with clean washed sand. We actually find that we can make a stronger tile with the dust, even when using a less percentage of cement than used with the sand.

"The limestone dust is used by us for the manufacture of concrete roofing tiles, to the extent of 50,000 tiles per day, and we claim to make one of the strongest concrete tiles in the country. The dust has the following screen analysis:

"Plus 8 mesh	0.55%
Minus 8, retained 18	31.02%
" 18, " 36	23.40%
" 36, " 52	11.62%
" 52, " 100	20.89%
" 100	12.52%"

Strength of Mortar

Being more than a little impressed by the results quoted above, and believing that perhaps limestone sand and limestone dust were not as bad as engineers have often been led to believe, the writer obtained a few standard gradings (summer, 1939) of materials from different parts of the country and had some mortar briquettes made and tested.

Seeing the dust content of these samples, many engineers would condemn them immediately—and very few would expect them to give higher strength results than standard sand. The writer believes that many such limestone sands can be found in this country.

Conclusion

To many people the test results given in this article will be surprising, but to those who have been producing and selling limestone aggregates they are merely part of the evidence which is available to justify the faith they have in their product.

Naturally, the results of these miscellaneous tests are not always in agreement, and it would appear advisable to institute an extensive series of tests (although the present time may not be good for the purpose, in view of the international situation) to see just how the various properties of mortar and concrete are affected by varying amounts of different limestone dusts and limestone sands. All types of limestones should be considered, as it seems reasonable to assume that some will be better than others. Such an investigation would be lengthy, arduous and expensive, but it is suggested that the results obtained would be worth the time, trouble and money expended.

SIEVE ANALYSES

	Material JW %	Material WC %	Material BS %
Residue on 100 sieve	72.0	74.0	
" " 52 "	52.0	62.0	
" " 25 "	26.0	42.8	
" " 14 "	3.4	20.0	
" " 7 "	0.2	0.4	Not done
" " 3/16 "	Nil	Nil	
Fineness modulus	1.536	1.992	
Material washed through 170 sieve	27.0%	26.0%	

3:1 Mortar Briquettes and Cubes tested at 7 days. Lbs. per sq. in.

	Reference JW		Reference WC		Reference BS	
Specimen	Lime-stone	Standard Sand	Lime-stone	Standard Sand	Lime stone	Standard Sand
Briquette	900	710	820	710	830	670
Cube	8680	8260	not enough material for cube		9400	8160

Industrial Statesmanship in the Reconstruction of American Enterprise[1]

By ALFRED P. SLOAN, Jr.
Chairman, General Motors Corporation

• **Industrialists have too long concerned themselves almost exclusively with their own specific business problems with disastrous results. A new era is dawning—an era which requires the development of industrial statesmanship if we are to safeguard the private enterprise system. Mr. Sloan's observations on this important subject should be found intensely interesting.**

"A RECONSTRUCTION Program For American Enterprise" is the title the National Industrial Conference Board has chosen for discussion this evening. From this title I would assume that all are agreed that something destructive has happened to American enterprise and something or somebody is in need of reconstruction. Unfortunately, that is only too true. On the eve of a national political campaign and in a life and death struggle between two opposing ways of life, it seems appropriate to review briefly a few of the more serious forces that have proved so definitely restrictive to American enterprise.

The present may be regarded as a bridge of time between two decades. The decade of the thirties was a period of apprehension and industrial stagnation and retardation. However induced, it was both prolonged and intensified by economic panaceas and political intolerance. Now comes the decade of the forties that might well be a period of renewed opportunity with the resumption of industrial progress unless over-shadowed by continued political interference with our essential economic processes. From 1790 until 1930, the industrial progress and living standards of America advanced continuously. The economy was free. The volume of industrial production in each new business cycle exceeded that of the preceding cycle. America was moving ahead.

In recent years private enterprise has been confronted with a number of destructive forces and other deterrents never heretofore experienced. Production of goods and services has fallen considerably since 1929. Although population is greater, yet the production is less, and millions are unemployed. Something has happened. The American industrial system of enterprise and its leadership have been charged with the responsibility for the ills and misfortunes of the economy and their impact upon the people. We shall examine into that question for a moment, but before doing so let us consider another question. One that so concerns us as we meet together this evening.

[1] Delivered at the 24th Annual Meeting of The National Industrial Conference Board, Waldorf Astoria Hotel, New York, May 22, 1940.

Resistance to Force and Aggression Paramount Issue of Today

The paramount issue of the day, and the subject first in the minds of all of us, is resistance to force and aggression, the preservation of our American way of life. To insure this, it is clear that it is of vital concern to us that the standard bearers of democracy emerge victorious in the present struggle. Any other result would be a catastrophe to civilization. Today both national and international morality in respect to human rights is largely passing out of the consciousness of those responsible for their preservation. Hence there is demanded a policy of intelligent and aggressive preparedness in defense of American security and our way of living. Both are essential to us. The instruments of warfare of today are the most highly technical products of industry. We should start with the recognition of that fact and demand that the essential program be directed by those possessing the technical knowledge and experience to assume such a great responsibility unencumbered by the demoralizing influence of the political consideration. There is a job to be done. Let us do it intelligently, not hysterically. Certainly after the past seven years of financial dissipation, we should know that we are no longer in a position to afford any degree of such luxury. National defense should be the keynote of our national policy. National security has become essential to national confidence. Thus our problem becomes two-fold: construction of national defense and reconstruction of economic policies.

National Defense Keynote of National Policy

Lack of adequate defense is due to lack of foresight. The essential element of statesmanship and national leadership is foresight. Without foresight, real statesmanship can not exist. Perhaps in the

days to come we will wonder how we justified the attitude of yesterday in relation to the world situation. The argument might well be advanced that a more realistic attitude on the part of the world's democracies toward the problem of preparedness in the face of the threatening storm might have avoided the catastrophe.

American enterprise comprises thrift and skill; in other words, capital and management. Our democratic traditions gave equalitly of opportunity and equality of responsibility, placed no handicaps upon success, encouraged every individual to seek as high a place in business, the professions, or in politics as his ability would justify and honored him for his accomplishments. That has contributed markedly to the outstanding success of American enterprise. In consequence, our industrial population earns more in purchasing power and enjoys a higher standard of living than any similar group anywhere. America with seven per cent of the world population enjoys more than fifty per cent of the world's wealth. That is the result of our system of enterprise. The primary objective of private enterprise must be to produce more and a greater variety of useful things always more effectively, so that they may be sold at always lower prices. Reduced prices mean more may use and enjoy industry's products and more may be employed in the production of an expanding volume. Business is the outstanding activity of any civilization. Society and government exist only through the success of business. Because of this dependence of society upon business, an intelligent and beneficial leadership for the one should imply simultaneously an intelligent and beneficial leadership for the other. Business and government should cooperate on the basis of an intelligent interest in the common welfare and with proper respect for each other. Sad are the facts today.

Industrial leadership exists in an atmosphere of reality. Therefore, industrial experience should contribute importantly toward a fundamental understanding of the necessities of the community as a whole. Industrial leaders devote their lives to the solution of the problems of the economic world. The impact of those problems reacts on the progress and stability of society. Political leadership involves too often the emotional appeal rather than the logic or facts of realism. Emotionalism has secured an undue influence even in our democracies—dangerous because of its lack of intelligent control. And this power is too often obtained through speeches, gestures and appeals of a propaganda character purposely addressed to this emotionalism and sentimentalism. It is effective only because of a lack of fundamental understanding on the part of the multitude. Industrial leadership involves an entirely different approach to the solution of any problem than political leadership. It is important that the community be made to understand these distinctions in order that it may more intelligently decide where its best interests lie.

I think it is a fair statement that the major current forces now adversely affecting our system of enterprise are not economic or social problems but are rather political in character. Our enterprise system may be regarded as engaged in a life and death struggle. It is under attack both from within as well as from without.

While there may be only a few among us who openly advocate the substitution of some form of state socialism for the American system of enterprise, there are far too many who advocate economic policies that inevitably lead to that result. The alternative to the American form of enterprise is regimentation under bureaucratic or dictatorial control.

It may not be fitting for industrial leadership to take any political position as such. Business in politics is usually recognized as bad policy but it is of vital consequence that industrial leadership assume a greater and broader responsibility in support of the American system than has been the practice in the past. If we desire to continue to enjoy the manifest fruits of free enterprise we must be willing to work and fight for our convictions. Industrial leadership can and must take an economic position as affecting its abilitly to contribute to the general welfare. In that area lies the interest of the American system of enterprise and all those who earn their living.

The Need for Industrial Statesmanship

In the past industrial responsibility has been concerned with the production and distribution of an ever *increasing* volume and variety of useful goods and services at *decreasing* prices. But for many years past I have been convinced that industry's responsibilities can not be adequately discharged, with the mere physical production of goods and services. As our national economy becomes more and more involved, the margin of error within which we can operate and maintain economic and social equilibrium, to say nothing of the vital urge for progress, is being constantly narrowed. Hence a much broader responsibility must be assumed. Industrial leadership must seek to develop ways and means to better

correlate our industrial mechanism and its component parts with the national economy as a whole, in order to more effectively promote human progress and security and to advance civilization. Inaction means the challenging of free enterprise. Failure means the urge for more and more political interference.

This philosophy is not new. It was laid down over five years ago. I asserted at that time that industrial leadership must evolve into industrial statesmanship. If we are to remain a democracy, if we are to perpetuate free enterprise, it is essential that through the process of mass education, we develop a better and broader understanding of not only the factors involved in our complicated economy, but also the economic consequences of the things that we do or do not do, as influencing the lives and happiness of our people. Much progress has already been made in many directions. But we must move forward on a far wider front, and far more aggressively. That is a most important plank in our platform of reconstruction of our enterprise system.

Many so-called reform measures now undermining the enterprise system have been prompted by the laudable desire to correct an apparent evil or abuse but too often without adequate understanding of all the facts and circumstances and to often without the requisite knowledge of the fundamentals as to how the desired result should be accomplished intelligently. We must be concerned with the correction of evil but we need not destroy something of greater value in the corrective process. Apparent evils are sometimes merely transitory phases and are essentially self-corrective with the passage of reasonable time.

Capitalism Inseparable from Freedom and Democracy

It is important to realize that a planned economy is wholly incompatible with the provisions of the Bill of Rights. The social and economic philosophy of capitalism is inseparably linked with freedom and democracy. This war is a revolution against democracy and the whole way of living which has been developed with it. It is important to remember that we have had eight years of so-called emergency. Hardly a single emergency power has been relinquished, even though in most instances the emergencies have passed. In the present world situation it is quite possible that new centralized controls may become essential. There lies a great potential danger to free enterprise. Therefore it is of the utmost importance that all emergency powers and controls be relinquished automatically upon the conclusion of the emergency that brings them into being. The record of the past few years gives little confidence that such a result would ensue. Such is the trend and as long as it continues confidence, an essential component of the enterprise system, is endangered.

Looking ahead, and from the standpoint of its broad implications, the present danger to America of becoming involved directly in the present world emergency, is not so much the loss of wealth; it is not only the loss of life, terrible to even contemplate, but it is the very serious possibility, or even probability that with it would go the American system of enterprise. That is a danger. It is a real danger. We must stand continually on guard.

Private Enterprise System Based on Profit Motive

The private enterprise system is based on the profit motive. It must create a profit. It must earn the payroll. In an expanding economy there must be a saving of surplus out of production. And that saving must be risked in the hope of making an adequate profit. Savings thus provide the venture money or equity capital for the expansion of enterprise. Although we speak of a profit economy, it is really a profit and loss economy. It is the hope of profit that provides the urge to assume the risk. Thus the possibility of loss must be reckoned with the opportunity for profit. While a limited number of well managed enterprises earn a profit, over the longer term most enterprises result in loss. And in the aggregate the return is hardly equal to a reasonable rate of interest. Our system of taxation takes far too large a proportion of the possible profits and the investor must assume the entire loss. The venture spirit that has made American enterprise is largely frozen in an uneconomic attempt to penalize outstanding accomplishment. That should be considered in our platform of reconstruction. But those who can least afford it suffer the most.

I mentioned economic panaceas and political intolerance as influences restrictive to enterprise. As to the latter, little need be said. I remind you of the story how in other countries they knight conspicuous success, while in our country the practice has been to indict that success, and without just discrimination, and when not possible in a Court of Law, then before the court of Public Opinion. I speak feelingly because I have had it both ways. This is another factor in our reconstruction program.

Expanding Economy Necessary

As to specific economic panaceas, these are well known to all of us. They have been discussed freely and frequently. Time does not permit their consideration here. This might be said however, only by an expanding economy can we have a greater supply of useful goods, a higher standard of living and reduced unemployment. The return of confidence in the long-pull position of the enterprise system is an essential step before an expanding economy is possible. Increased wealth means increased production. Restriction on production, the theory of scarcity, the political creed of today—together with the idea of getting something for nothing—should have no place in the American system of things. Our motto must be the 'theory of plenty'. Sooner or later we will learn that we cannot penalize some for the benefit of others. We are all a part of the same economy. Sooner or later we will learn that wages are determined solely by the productive opportunity given the worker. We may by law require that the wage rate be raised to a definite level or hours reduced, or both, but we take from some and give to others. There can be no gain.

You know and I know that the only way to provide more things for more people, in more places, the theory of plenty, is by increased efficiency through capitalization of technological improvement, more productivity per worker and more hours of work per week. With the national policy of establishing a definite ceiling on the hours of work, we now propose to plug the one remaining opportunity for progress and place a tax upon technological progress. Taxes once placed usually increase, hence the ultimate result is bound to more and more limit the increase in efficiency of production otherwise possible. Aside from the depressing economic effect of such a policy on the economy as a whole, we are erecting a specific barrier against the capital goods industries which, in terms of employment, directly, and in services related thereto, employ one-half our workers. This is an astounding proposal. And undoubtedly the most effective economic barrier against industrial progress yet advanced and there are many of them. That certainly has no part in our program. On the *contrary* a soundly conceived plan to encourage, by incentive taxation, technological progress could well be considered. Higher wages could be sustained, lower prices would be possible, employment stimulated—true factors in an expanding economy. Such a program has demonstrated effectively its usefulness elsewhere.

Some time ago a highly placed public official stated in effect, in speaking of the unemployment problem, that it could be solved easily, if properly attacked. His plan was to reduce working hours as far as necessary to create additional jobs, maintaining the same wages as at present for the reduced working week. That same idea is being constantly advanced—the 30-hour week. It is a very dangerous proposal. Why is it we cannot understand that money wages must be considered in terms of what the money will buy? Where is the gain to the economy when prices must rise in the same proportion as wages? We cannot raise ourselves by our own boot straps, yet that is what we keep continally trying to do.

American Enterprise One of Small Units

In any broad approach to the problems of our economy, we must not fail to realize that, after all, American enterprise is largely one of small units. About two hundred thousand new businesses are started each year with an average of 7 employes. Too often we examine into some question using as an example one or more of our great industrial units. If the idea is to attempt to prove some desired point nothing more need be said. If it is to get the real facts, such conclusions are far from indicative of the condition of the system as a whole. The encouragement of small business is of vital importance in the problem of an expanding economy. High taxes on business and personal incomes add to the difficulty of making savings. In looking back over the years to the beginning of many of the enterprises now a part of General Motors, it is clear that in those early days their lives were in frequent jeopardy due to lack of adequate capital. And yet, while those enterprises were then employing relatively few workers, now they are employing tens of thousands directly, and indirectly hundreds of thousands more. Today with conditions as they are, the mortality of such struggling enterprises must necessarily be higher and yet they are vitally needed, not only because of themselves but because they are frequently the beginnings of far greater things.

Encouragement of small business units is an essential part of our plan of reconstruction. The most intelligent approach is the broad one of doing those things that will expand the economy as a whole and make it practical and worthwhile to take the risk.

Democracy or Autocracy

Perhaps some of us may sometimes wonder as to the effectiveness of an industrial system under an autocracy as compared with that of our democracies. It seems to me that this is perfectly clear. Short hours cannot compete with long hours. An obsolete technology cannot compete with an advanced technology. An economy tolerating millions of unemployed cannot compete with an economy providing full employment. Efficient organization and management cannot compete with the inefficient, and all this under all circumstances. But, on the contrary, personal initiative, the reward of accomplishment, ambition to succeed, full scope for one's talent, the honor of one's neighbors—all component parts of our system of free enterprise—must, from the very fundamentals of human reactions, always be more effective than any regimented individual—the by-product of a planned economy.

Evolution of Industrial Statesmanship

Thus, through philosophical discussion we have evolved the concept or principle of high generality and low generality. And the need of one as compared with the other—an important distinction in determining industry's part in our program of reconstruction. The specific technical business problems, such as engineering, production, distribution, etc.—the very essence of business—are ideas of low generality, whereas ideas regarding the business as a whole in its relationship with the community as a whole, are ideas of high generality. Obviously, high concentration of thought and effort on ideas of low generality are essential to business success. There can be no short-cut—no neglect of these ideas. But that is not enough. Attention must also be given to the development of ideas of high generality, as a social philosophy. Thus we pass from industrial leadership to industrial statesmanship.

It is essential for business management to become deeply absorbed in the details of problems of immediate urgency—administrative management, in other words. While these can not be neglected, there must be some definite division of organized effort so that there will be no neglect in the development of a social philosophy which will carry forward aggressively the novelty of social and economic invention—policy formation, in other words. The latter determines the fundamental concepts of the business and evaluates the problems before it in terms of its future progress and stability, its relation to the economy as a whole and its obligations to the social order. The former deals with engrossing problems of administration found in any business. The General Motors scheme of management provides for a separation of ideas of high generality from those of low generality and requires executive attention to both phases of management. This is essential to industry's broader responsibility in this period of rapid change through which the economy is now passing.

Undoubtedly we are now hammering out a social economic philosophy to carry on for the future. The development of a business philosophy obviously is the job of business statesmanship. Those devoid of actual experience in business can not develop a philosophy consistent with business needs or construct satisfactory operating policies for its conduct. We have seen already that those with little experience wholly unqualified as to the technical necessities of business, such as politicians and reformers, are making inroads on the management and operation of the enterprise system through regulatory and actual control procedures. The result establishes the fact.

Social Trends Must Be Recognized

It has always been the responsibility of industrial management to keep ahead of the consumer demand for its goods and services. It now becomes the responsibility of industrial statesmanship to recognize the social trend in relation to its own problems. Thus enlightened self-interest and the needs of the society as a whole, properly coordinated, assume a partnership relation in a common effort. The enterprise system becomes an integral part of the whole community and not in any sense an abstraction or something apart from the general economy. Just as free society or democracy is dependent upon successful enterprise its perpetuation becomes more assured as industrial statesmanship assumes this obligation. It may be regarded as one of the essential elements, perhaps the keystone of a program of reconstruction of our free enterprise economic system. Upon its acceptance depends the perpetuation of that system.

The Enterprise System Must Go Forward

Conditions and influences change. The present period is one of great and rapid transition and one of great potential danger. The enterprise system must be progressive. It must keep in touch with the changing environment. The manifold and demonstrated benefits of the free enterprise system demand that those involved with its responsibilities fight to the utmost proposals based upon the philosophy of

scarcity. Such a philosophy together with too much emphasis on the importance of security, leads to stagnation of the economy. We have seen that a progressive economy must contemplate the element of risk. Set-backs must be expected. However, the underlying forces and influences will overcome false doctrines if given an opportunity to assert themselves. The enterprise system must go forward.

No Lack of Opportunities

Much of the industrial equipment of America is far from modern. A tremendous opportunity exists to rebuild America on the basis of today's technology. Complete modernization, superimposed upon the demands of the consumer industries, would employ all available labor for years. The work week might well have to be increased, especially giving consideration to the increased production of goods and services now required for national defense. An economic solution of the housing problem would employ a new technique, new materials and require large-scale production methods. There lies one of the most important tasks of industry, looking toward the future. It offers the greatest industrial opportunity of modern times. If an intelligent attack on the living standards of the so-called 'submerged third' were made it would create an additional and large market for consumer goods.

Thus we see real opportunities for the investment of our present and future savings. There is a big job to be done. I emphasize this point because today there are so many who fear, and have apparently satisfied themselves, that today and tomorrow our opportunities may not be adequate to employ our savings. That means a static economy. If that proves true it will be solely because government has continued to maintain excessive obstacles against enterprise and the prospects of business profits.

Industrial Statesmanship Faces Grave Responsibilities

It is to be hoped that the domestic political and economic abuses and limitations which have beset industry for so many years may come to an end or be corrected to an important degree in this year 1940. Should that occur, it would almost certainly be construed by the business community as justifying a return of confidence in the long-pull position of constructive enterprise. Unemployment no longer will be a national problem. On the other hand, the policy of encouraging instead of discouraging constructive enterprise and the return to national economic sanity must not be interpreted by industry as a license to re-establish any previous order inconsistent with the broader trend of economic and social change—absolutely not. On the contrary, it should be regarded by industrial statesmanship as a period within which it must justify its ability to assume these broader responsibilities. Therefore the five-year period just ahead is certain to be a most critical period. It will be a period of transition and formation in which the economic system of free enterprise must reassert itself. It will be a period in which those possessing the ability and responsibility of industrial statesmanship must exert all the intelligence they possess; with all the courage at their command to formulate constructive policies designed to steer the economy on a safe and reasonable course. This responsibility to future generations is almost beyond our conception. Never before has the occasion demanded that industrial management assume such a responsibility—the reconstructing of the economy on a firm foundation of economic law. Tremendous as these problems unquestionably are, there will be superimposed upon them additional responsibilities of even greater magnitude—to an extent we can not now determine—the problems incidental to the post-war period.

Thus it is evident that the future—today, tomorrow and beyond—demands the coordinated effort of the most experienced and intelligent among us. In addition it demands the courage that comes from the firm conviction that economic truth crushed to earth will rise again. It must be patriotic. It can not succeed as a partisan effort. And further, it must not fail.

Highway Economics Research Begun by ARBA

WASHINGTON, D. C. (*By Highway Information Service*).—The inauguration of a Highway Economics Division, the first "highway laboratory" of the nation, designed to gather and distribute information and data on highway construction and maintenance, was anounced today by the American Road Builders' Association.

With the increasing need of more efficient highway programs throughout the country as an urgent factor in adequate national defense, the ARBA executive committee and board of directors authorized the association's technicians to create a bureau long needed as a highway economics "clearing house" for the road-building profession and industry.

Can You Afford Your Specifications?[1]

• A discussion of the effects of specialized aggregate requirements on equipment types, plant methods and production.

THE production of construction aggregates to meet the many, and exacting, specification requirements demanded by design and material engineers, has reached a stage where it might well be called a profession instead of a business.

The producer must be an engineer to understand the specifications, an excellent organizer and operator to meet the shipping requirements of the contractor, a mechanic and construction man to build and keep in operation an efficient plant, a prophet to foresee and forestall the effects of major specification changes, a super salesman to get the business and a magician if he is to make any money.

The volume of business necessary to support a large modern plant, pay interest on investment, operating and maintenance costs, replacement of worn or obsolete equipment, to say nothing of such minor items as demurrage, rejections and profit, is large even at good prices. But in many areas competition has driven prices far below range of fair profit.

As a result, the ingenuity of equipment and plant designers as well as operators has been taxed to the utmost in providing ways and means to cut costs without reducing the quality demanded by standard consumer specifications.

This, however, has been done. The aggregates now produced, though costing no more, and often less, are superior in quality to any even hoped for in past seasons. The modern plant is flexible in operation and can meet normal fluctuations in the demand for standard sizes. Major plant designers have been consulted and have often assisted in the development of specifications acceptable to national groups of materials engineers and consumers in general. In these specifications three groups of requirements other than physical or natural quality, demands which are limited by availability, have become more or less standardized.

1. Requirements for particle shape. Crushed aggregates should be cubical rather than flat or elongated, and a certain percentage of crushed particles has been considered desirable in many gravel specifications. Types of crushers are available for every purpose.

2. Requirements for particle size. A limited number of major size gradations have been adopted as standard by the national associations and combinations of these sizes will meet most normal size requirements. The shaker or vibratory screen provides a clean cut separation of sizes, and the carry-over of objectionable quantities of smaller sizes has been corrected.

3. Requirements for particle cleanness. Specifications for cleanness are similar in most cases. Particle coatings are prohibited, as are noticeable amounts of clay, dirt or other foreign matter. Washing equipment is available which will clean almost any aggregate.

An added requirement during recent years is that of uniformity. Specification writers have aided the producer in meeting this demand by the use of split sizes which are proportioned at the site of the work.

In so far as the producer and the consumer work together in these developments, it is possible for the producer to provide the consumer with a high quality aggregate at a low unit cost. Both the consumer and the producer will profit.

But the free lance specification writer can, and usually does, upset the apple-cart. His requirements, if materially different from accepted practice, may be most desirable, but are they worth what they cost? Has he developed his specification on proved results or as a matter of personal opinion? Can he justify the added cost by improved construction. If he can, his conclusions should be given to engineers at large for possible adoption as a standard.

The producer has been aided in eliminating two costly factors in his operation; first, excess waste caused by a gap between the limiting sizes of a coarse and a finer aggregate; and secondly, that caused by an overlap of sizes, which is a serious drain at the point of overlap and usually makes it impossible to produce both sizes with one run of material through the plant. Each unnecessary re-run of material is an additional production cost.

Therefore, the standard sizes, as now generally adopted, have had to be selected with extreme care to avoid these losses.

[1] Editorial reprinted through courtesy of the *Earth Mover and Road Builder*, appeared in July 1940 issue.

The U. S. Bureau of Standards, Public Roads Administration, and most state highway commissions are using these standards successfully, and there are surprisingly few deviations. They have been adopted after experience and practice on a large scale both in research laboratories and field construction.

There are, however, many cases where special specifications have been adopted to fit some local condition. Because of the physical characteristics of an aggregate, it may crush or screen to provide an excess of some particular size. To benefit by the use of this material, usually at a low cost, some special mix may be developed which *in that locality* proves to be highly satisfactory. Even experienced specification writers will occasionally make the mistake of specifying a similar material in a location where the cost of its production is prohibitive.

Several years ago, the highway engineers from a mid-western state visited a neighboring state and were intensely interested in the surface texture and riding qualities of the bituminous surface courses in that area. When told that the "one size" aggregate used was furnished at $.75 per ton the visitors decided to adopt and did adopt the specification as a standard, without considering the fact that where it was in use that aggregate was a waste product.

In the adjoining state very little of the new type road was ever constructed as bids received on the required aggregate varied from seven to eleven dollars per ton.

While this is an extreme case, it is always poor practice and usually costly to adopt another's specification that does not tie into local conditions. A second "price raiser" is the practice of frequent specification change. No specification should be made a standard without proper consideration of its value, and, if possible, the use of trial sections.

The expense to the producer of equipment change and modification of plant operation may run into thousands of dollars to meet even the lesser change in the delivery price of aggregates. If they are absorbed over a considerable period of time, the effect on prices will be small, but if they must be written off in one season or less someone has to pay for it. It won't be the producer, or his bank will soon be in the aggregate business.

Engineers will often save money by fitting their road types to available aggregates instead of trying to find aggregates to fit some particular type of road. In one locality both stone and gravel were available but the gravel ran too fine for a satisfactory concrete aggregate. As specification was written permitting the use of coarse aggregate in two sizes of which the finer could be gravel and the coarser crushed stone, uniformity was provided by requiring weight proportioning through which every batch had a uniform quantity of each. Because of the available quantities of both aggregates, normal competition kept the cost down.

A specification so written as to rule out one material in favor of another is costly as it removes competition. Certain specifications for crushed aggregates have contained requirements which by their nature prohibited crushed gravel, although boulders and coarse gravel of extremely high quality were available for crushing and would have provided excellent aggregates.

To summarize: The engineer pays for his specifications and he pays dearly for a specification assembled by hit-or-miss methods. He also pays for his "custom made" materials.

Specifications developed after years of study and meeting the needs of both producer and consumer are available for adoption and should not be disregarded.

Specials are efficient only when developed to utilize available low-cost materials.

Changes are undesirable as adopted standards until proved beneficial by trial sections or conclusive investigation.

Varying sizes should be adopted from published standards if feasible, but in any case they should eliminate, in so far as possible, waste by gap gradings, overlap of sizes, and re-handling of materials.

Unusually severe requirements for various items such as cleanness, grading limitations and physical characteristics should be avoided.

An efficient specification is one which is sufficiently restrictive to assure quality but broad enough so that its requirements can be enforced; and written to utilize to the best advantage competitive available materials.

If the producer is provided with a specification which can be met with efficient operation and he has some assurance that it will remain unchanged, at least in major details, over several seasons, he will seldom protest its severity and the consumer will benefit by a reasonable price range.

Highways for America's Defense[1]

By HON. JENNINGS RANDOLPH
Representative from West Virginia

MR. SPEAKER, we are agreed on the importance of continuing our Federal-highway program. As we consider this bill Members recall the war preparations of European nations over the past several years. We were informed of these developments through our daily press and nationally circulated periodicals. We constantly read of extensive mechanized divisions, large navies, and great air forces. We hourly hear about preparations in all phases of warfare, except the roads which ultimately lead a great bulk of these forces into battle.

Hitler Used Roadways

In Hitler's rush to the French coast, roads have been his pathways of conquest. In like manner the Allies have found good highways a major asset in concentrating mobile units for combat with the Nazi legions. We, therefore, are led to conclude that, hand in hand with armed preparedness, roads must be considered and built from a military viewpoint. No longer are the so-called invulnerable fortifications the devices on which to hang national security. France's recent experience has proved this.

General Weygand's recent elevation to commander in chief of the Allied forces has changed the tactics of the combined armies. A brilliant strategist and a soldier of quick daring, General Weygand has sent his armies to meet the invaders in the open terrain. He got his cue from Winston Churchill's recent speech—

"The armies must cast away the idea of resisting attack behind concrete lines or natural obstacles and must realize that mastery can only be regained by furious and unrelenting assault."

Thus the warfare of Europe today evolves from highways running in all directions. Tank divisions, tractor-drawn artillery units, and infantry mobilized into truck brigades are rapidly transported over wide areas of warring activity to meet the onslaughts. A little over a week ago it was reported, in the Belgian crisis, three of the seven highways connecting Belgium and France were reserved for Allied troop movements to the north.

Swift Advance Possible

All the pictures of this present conflict that reach our newspapers and magazines show mechanized units moving over highways in the open country. Such a swift advance on wheels is formidable, unless it is met at the point of invasion with tank for tank, armed car for armed car, and man for man.

We have this modern war strategy before us and we know what part good highways play in its success or failure. We have seen destruction ride across Europe on rubber tires and set new records in military achievement. What has been wrought by the gods of war, in the way of crushing nations, we must look upon as a poignant lesson to be heeded now in our peacetime preparations.

Our national defense can never be considered complete until we have ironed out our Nation-wide roadway problems. In our haste to bridge the gaps in equipment necessities, we must not forget that what we are building in mechanized units must depend on first-class highways for their swiftness and effectiveness. To carry the weight of this thundering equipment, moving at high speed, many of our existing highways throughout the country must be either materially improved or rebuilt and rerouted to provide the greatest service in time of national distress.

Texas Is Example

In our deliberations on H. R. 9575 today we can very well keep in mind the recent report made by the Texas Highway Commission and sent to the chairmen of the Senate and House Committees on Military Affairs, and also to the chairman of the Senate Committee on Post Offices and Post Roads, and to our own fine House Roads Committee chairman, the Honorable WILBURN CARTWRIGHT, of Oklahoma. That report was made by Robert Lee Bobbitts on the Army maneuvers in East Texas and Louisiana, as they concerned highway and roads. Certain very definite conclusions were reached. I quote from that report briefly:

"The recent Army maneuvers in Texas and Louisiana and the transportation situation in Europe in recent weeks have emphasized the necessity and caused all of us to give a lot of thought and attention to the

[1] Speech made in the United States House of Representatives, Monday, June 3, 1940, on the 1940 Federal-Aid Highway Bill.

adequacy of our highways from the standpoint of national defense.

"1. The roads used in connection with the maneuvers, which were of a standard comparable to those set by the War Department for military roads, have stood up reasonably well. However, these roads comprised only about 25 percent of the roads used.

"2. The roads of lower-type construction were inadequate to carry the traffic, even of the very light type of motorized equipment used. We understand that the heaviest tank was only 10 tons and that the heaviest gun was a 155 howitzer, which is light equipment when compared with that now being utilized in modern warfare.

"3. Many of the bridges and culverts were inadequate and the Highway Department built detours around them, which became impassable, however, during rains.

"4. There was considerable disturbance to normal traffic, which would indeed have been critical under actual war conditions where civilian population is fleeing while troops and supplies are being moved. Normal traffic in the area of the maneuvers was very light, probably averaging less than 200 vehicles per day on the roads involved so that the traffic friction between military and civilian vehicles was much lighter than would be found on any of the designated military highways in our State.

"5. Prior and in preparation for the maneuvers the State highway department spent considerable money resurfacing certain paved roads in the area which were deemed to have sufficient base, and during the maneuvers the maintenance division of the highway department kept crews constantly maintaining and patching the roads.

"While this information is not complete it is obvious that the conclusion must be reached that thousands of miles of our highways, which are reasonably satisfactory for present normal civilian traffic, are totally inadequate for military purposes.

"Just as soon as the additional definite data is available, it will be forwarded to you for your consideration. As is generally known, extensive Army maneuvers have been held in different portions of the State from time to time and we have had the experience in such matters that we feel should be brought to the attention of the Congress for their consideration. It should be distinctly understood that this information and report is submitted from the facts and experience through which we have passed, and because of our interest in adequate national defense and all that goes with it. As a matter of fact, we have made these recommendations, suggestions, and requests before the present unprecedented critical situation arose.

"It is now academic that the reason the German Army has been able to crush the opposition with such devastation and rapidity is the fact that it planned ahead of time and not only had the equipment but, at least in its own country, the road facilities over which to move the equipment and manpower as well as supplies.

"It is our desire, in all possible and proper ways, without any desire or thought of doing anything other than trying to be helpful on the proper basis, to submit the facts and experiences which we have had and to do anything in our power that might be considered to be helpful to the Congress in these tremendously important matters."

No Lessening of Program

I trust there will be no opposition to this measure today. The members of the Roads Committee, and the House membership generally, recognize the need for a continuance of our Federal road-building program. We are conscious of the defense implications, especially this year, as we bring this bill to the floor. There can be no lessening of the work being carried on at the present time.

"Federal Aid Will Open Wagon Roads to All," Said U. S. Congress in 1915

With the present U. S. Senate recommending $100,000,000 for Federal Aid it is interesting to read in "Government and Economic Life" just published by the Brookings Institute the following comments of the Joint Committee of the 63rd Congress on Federal Aid in the Construction of Post Roads:

"The congressional committee which studied and reported on the desirability of federal aid for road development observed with approval that

> ". . . a great system of rural transportation would be developed with rates regulated by actual competition, open to poor and rich alike, as no expensive privately owned terminals, roadbeds, tracks, or equipment would be required. The good wagon roads would be open everywhere to the use of everybody, and the equipment, relatively inexpensive, would be within the means of many."

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